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B

Level 3 Exemplar 1
Paper 1B

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2022

CHEMISTRY PAPER 1

SECTION B : Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5, 7 and 9.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) This section consists of **TWO** parts, Parts I and II.

(4) Answer **ALL** questions in both Parts I and II. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(5) An asterisk (*) has been put next to the questions where one mark will be awarded for effective communication.

(6) Supplementary answer sheets will be provided on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this Question-Answer Book.

(7) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

A140E01B

PART I

Answer **ALL** questions. Write your answers in the spaces provided.

1. Iodine is a halogen. It can form potassium iodide and hydrogen iodide.

(a) Name the relationship between $^{127}_{53}I$ and $^{129}_{53}I$.

$^{127}_{53}I$ and $^{129}_{53}I$ are isotopes of the same element.

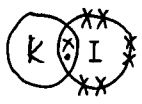
(1 mark)

(b) The electronic arrangement of an iodine atom is 2, 8, x, 18, y. What is x ?

x is 7

(1 mark)

(c) Draw the electron diagram for potassium iodide, showing ELECTRONS IN THE OUTERMOST SHELLS only.



(1 mark)

(d) Suggest why an aqueous solution of hydrogen iodide can conduct electricity.

An aqueous solution of hydrogen iodide provides mobile ions to conduct electricity.

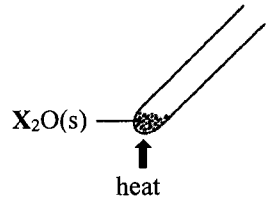
(1 mark)

(e) In terms of bonding and structure, explain whether potassium iodide or hydrogen iodide would have a higher melting point.

Hydrogen iodide would have a higher melting point. Because the hydrogen bond between H and I are stronger than the ionic bond between K and I. So it requires more energy to break down the hydrogen bond between H and I while it requires less energy to break down the ionic bond between K and I. (2 marks)

Answers written in the margins will not be marked.

2. The diagram below shows an experimental set-up in which a metal oxide $X_2O(s)$ is decomposed upon strong heating. A silvery metal **X** and a colourless gas **Z** are formed.



(a) State what **Z** is and suggest a test for it.

Z is oxygen and it would relights glowing splint.

(2 marks)

(b) When 3.028 g of $X_2O(s)$ is completely decomposed, 2.819 g of metal **X** can be obtained.

(i) Calculate the relative atomic mass of **X**.
(Relative atomic mass : O = 16.0)

let x be the relative atomic mass of x.

$$\frac{3.028\ g}{(2x+16.0)\ g\ mol^{-1}} : \frac{2.819\ g}{x} = 2 : 4$$

$$\frac{3.028}{2x+16} = \frac{1.4095}{x}$$

$$3.028x = 2.819x + 22.552$$
$$x = 107.904$$

(ii) Suggest what **X** is.

X is Silver

(3 marks)

(c) Explain whether the decomposition of $X_2O(s)$ is a redox reaction.

Yes. Because the oxidation number of Ag decreases while the oxidation number of O increases.

(1 mark)

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3. Antacid is a drug for neutralising stomach acid. A sample of an antacid contains $NaHCO_3(s)$ and other soluble inert substances. 1.52 g of the antacid sample was completely dissolved in deionised water to give a weakly alkaline solution. The solution was then titrated with 0.644 M HCl(aq) using a suitable indicator. 25.20 cm^3 of the HCl(aq) was required to reach the end point.

(a) Write the chemical equation for the reaction between $NaHCO_3(s)$ and HCl(aq).

$NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l) + CO_2(g)$

(1 mark)

(b) Calculate the percentage by mass of $NaHCO_3(s)$ in the antacid sample.
(Relative atomic masses : H = 1.0, C = 12.0, O = 16.0, Na = 23.0)

$NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l) + CO_2(g)$

No. of moles of $HCl(aq) = 0.644M \times \left(\frac{25.20}{1000}\right) dm^3 = 0.0162$ mol

$\therefore n NaHCO_3 : nHCl = 1:1$

$\therefore n NaHCO_3 = 0.0162$ mol

mass of $NaHCO_3$ in the sample $= 0.0162$ mol $\times (23.0 + 16.0 \times 3 + 12.0 + 1.0)$ g mol^{-1}

$= 1.363$ g

Percentage by mass $= \frac{1.363\text{ g}}{1.52\text{ g}} \times 100\% = 89.69\%$

(2 marks)

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3. (c) The pH of the solution at the end point of the titration was found to be between 3 and 4.

(i) Suggest a suitable indicator for this titration and state the colour change at the end point.

methyl orange.

The colour changes from yellow to orange.

(ii) Suggest an instrument to measure the pH of the solution accurately.

pH meter

(3 marks)

(d) State one advantage of taking antacids containing $Mg(OH)_2(s)$ over those containing $NaHCO_3(s)$.

It is mild to human body

(1 mark)

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Answers written in the margins will not be marked.

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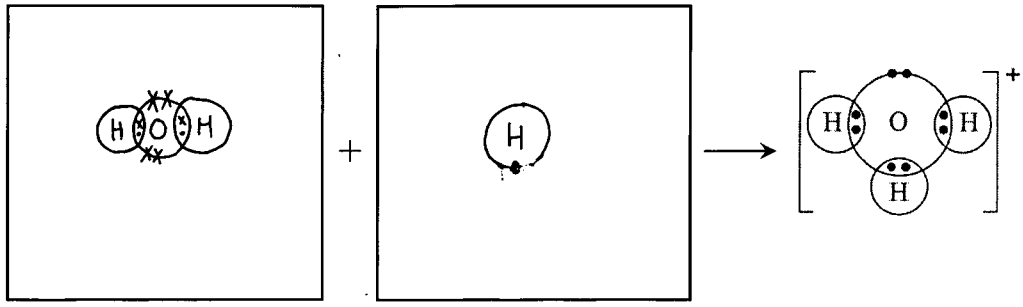
4. Consider the molecules H_2O, BF_3 and SF_6.

(a) H_2O molecules can form H_3O^+ ions.

(i) In each of the following boxes, draw the electron diagram (showing ELECTRONS IN THE OUTERMOST SHELLS only) for a suitable chemical species to show the formation of a H_3O^+ ion.



(ii) Describe the formation of dative covalent bond using H_3O^+ as an example.

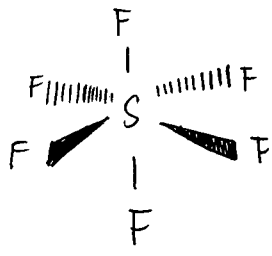
(3 marks)

(b) Explain whether the boron atom in a BF_3 molecule has an octet structure.

Yes. Because there are 3 B-F bond in a BF_3 molecule. And the outermost shell electrons of B is 3, each of the electrons combine with a F^- ion.

(1 mark)

(c) (i) Draw the three-dimensional structure of a SF_6 molecule.



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4. (c) (ii) Explain whether SF_6 is a polar molecule.

SF_6 is not a polar molecule.
Due to the electronegativity differences between S and F, S-F bond is a polar bond. But the polarity of each bond cancel out each other as they are in opposite direction.

(2 marks)

(d) Explain the following increasing order of the boiling points of the three compounds :

$BF_3 < SF_6 < H_2O$

~~The~~ Both BF_3 and SF_6 are non-polar molecule. But H_2O is a polar molecule as it has a lone pair electrons. So it has a higher ~~&~~ boiling point as a larger amount of energy is needed to break down the polar bond. Comparing BF_3 and SF_6, the molecular size of SF_6 is larger than that of BF_3. The ~~greater~~ stronger intermolecular force of SF_6 molecule would need more energy to overcome than that of BF_3.

(3 marks)

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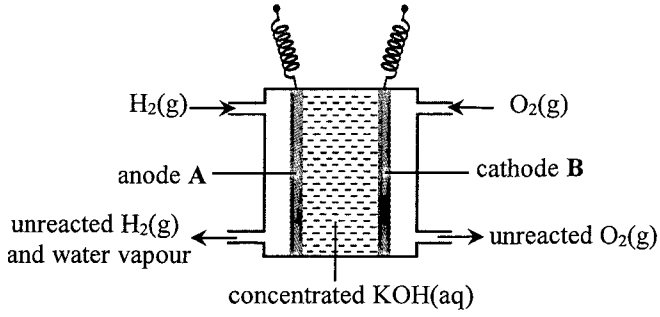
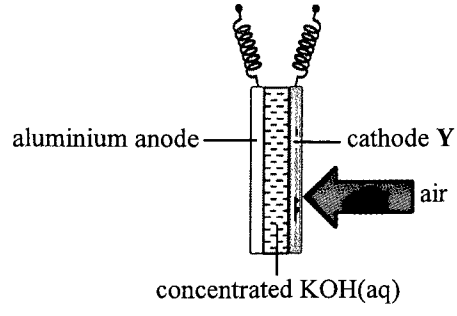
5. The following hydrogen-oxygen fuel cell and aluminium-air cell are primary cells. Their simplified structures are shown below :



hydrogen-oxygen fuel cell



aluminium-air cell

(a) What is meant by the term 'primary cell' ?

Primary cell is a set-up that can turn chemical energy to electricity and it is non-rechargeable.

(1 mark)

(b) For the above hydrogen-oxygen fuel cell,

(i) write the half equation for the change that occurs at anode **A**.

$H^+(g) + OH^-(aq) \rightarrow H_2O(l)$

(ii) suggest one disadvantage of using this hydrogen-oxygen fuel cell.

It is expansive

(2 marks)

(c) In the above aluminium-air cell, oxygen in air reacts with water to form hydroxide ions at cathode **Y**.

(i) Write the half equation for the change that occurs at cathode **Y**.

$O^{2-}(g) + 2H^+(aq) + 4e^- \rightarrow 4OH^-(aq)$

(ii) The half equation for the change that occurs at the aluminium anode is as follows :

$$Al(s) + 3OH^-(aq) \rightarrow Al(OH)_3(s) + 3e^-$$

Write the chemical equation for the overall reaction in the aluminium-air cell.

(iii) Suggest how aluminium can be obtained from aluminium oxide Al_2O_3.

electrolysis. ~~of its ore.~~

(3 marks)

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6. Consider the following chemical equation for the formation of CH_3Cl from methane and chlorine :

$$CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$$

(a) Name the type of reaction involved.

Addition reaction.

(1 mark)

(b) State the condition needed for the reaction to occur at room temperature.

Heat.

(1 mark)

(c) The reaction involves three stages: initiation, propagation and termination. In the initiation stage, chlorine free radicals (Cl•) are formed from chlorine molecules.

(i) With reference to the electronic structure, explain why a chlorine free radical (Cl•) is a reactive chemical species.

Because there is 7 outermost shell electrons in Cl atom. It has a strong tendency to get one electron to form an octet structure.

(ii) Complete the chemical equations below by filling in a suitable chemical species in each of the following boxes :

One of the steps in the propagation stage :

$Cl\bullet + CH_4 \rightarrow$ [ ] + [ ]

One of the steps in the termination stage :

[ ] + [ ] $\rightarrow CH_3Cl$

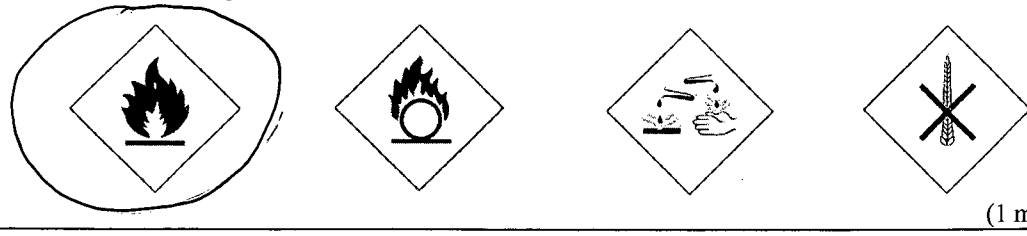
(3 marks)

(d) Explain why CH_3Cl is not the only organic product formed in the reaction between methane and chlorine.

Because there is major product and minor product

(1 mark)

(e) From the hazard warning labels shown below, circle a label that should be displayed on a gas cylinder containing methane.



(1 mark)

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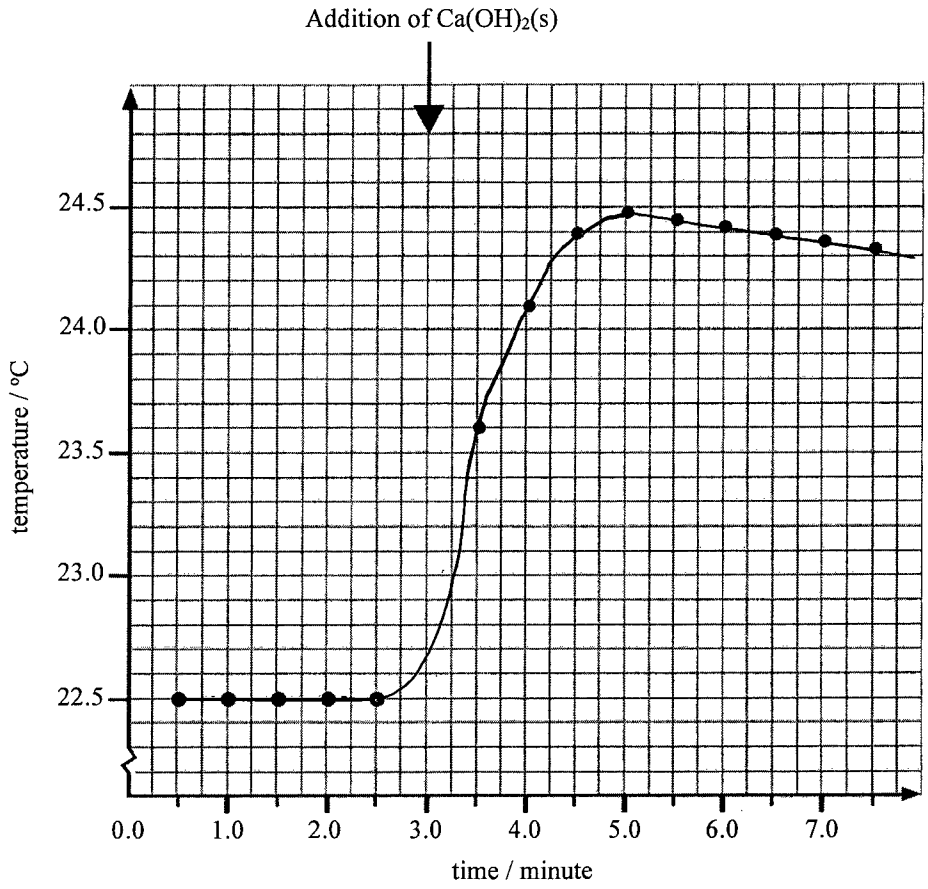
7. An experiment was performed to determine the enthalpy change of neutralisation between $Ca(OH)_2(s)$ and HCl(aq). 100.0 cm^3 of 1.0 M HCl(aq) was placed in an expanded polystyrene cup. The temperature of the contents in the cup was measured at half-minute intervals. Right at the third minute, 0.502 g of $Ca(OH)_2(s)$ was added to the cup with thorough stirring. The recordings of temperature are shown in the graph below :



(a) Write a chemical equation for the reaction between $Ca(OH)_2(s)$ and HCl(aq).

$Ca(OH)_2(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + 2H_2O(l)$

(1 mark)

(b) (i) By SKETCHING on the graph above, estimate the greatest temperature rise of the contents in the cup.

The greatest temperature rise = 2 °C

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7. (b) (ii) It is given that the enthalpy change of neutralisation is the enthalpy change when solutions of an acid and an alkali react together to produce one mole of water.

In the experiment, HCl(aq) is in excess. Calculate the enthalpy change of neutralisation between $Ca(OH)_2(s)$ and HCl(aq), in kJ mol^{-1}, under the experimental conditions.

(Volume of the reaction mixture = 100.0 cm^3;
density of the reaction mixture = 1.00 g cm^{-3};
specific heat capacity of the reaction mixture = 4.2 J g^{-1} K^{-1};
heat capacity of the expanded polystyrene cup : negligible)
(Relative atomic masses : H = 1.0, O = 16.0, Cl = 35.5, Ca = 40.1)

Heat released = mass × ΔT × specific heat capacity ~~of water~~

Heat released = $100.0\,cm^3 \times 1.00\,g\,cm^{-3} \times 2^0C \times 4.2\,J\,g^{-1}\,K^{-1}$

= 8400 J

no. of moles of water formed = 2 n $Ca(OH)_2$ (s)

$n\,Ca(OH)_2 = \frac{0.502\,g}{(40.1+16\times2+1\times2)\,g\,mol^{-1}} = 6.77\times10^{-3}\,mol$

$\Delta H_n^\theta = \frac{\text{Heat released}}{2n(Ca(OH)_2} = \frac{8400\,J}{2\times6.77\times10^{-3}\,mol} = 619960.16\,J\,mol^{-1}$

$= 619.96\,kJ\,mol^{-1}$

(5 marks)

(c) Standard enthalpy changes of neutralisation ΔH_n^θ for two reactions are given below :

	ΔH_n^θ / kJ mol^{-1}
Reaction between $Ca(OH)_2(s)$ and HCl(aq)	−58.6
Reaction between CaO(s) and HCl(aq)	−186.0

Calculate the standard enthalpy change of the following reaction.

$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(s)$

(3 marks)

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*8. Describe and explain the similarities and differences between the chemical principles involved in tin-plating and galvanising in the rusting prevention of iron-made objects.

(6 marks)

Tin-plating is plating Tin metal on the iron-made object. And galvanising is plating zinc metal on the iron-medal object. Both of the methods are electroplating. But galvanising is protects the iron by sacrificial method as zinc is a metal ~~more~~ that is more reactive than iron. As zinc would lose electrons more readily than iron. While Tin-plating is prevent the iron from contacting with the oxygen and water.

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PART II

Answer **ALL** questions. Write your answers in the spaces provided.

9. At a certain temperature, the equilibrium constant K_c for the following reaction is 2.25×10^{-2} mol dm^{-3}.

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g) \qquad \Delta H > 0$$

In an experiment, 0.84 mol of $PCl_5(g)$, 0.16 mol of $PCl_3(g)$ and 0.16 mol of $Cl_2(g)$ were initially introduced in a closed container of a fixed volume of 4.0 dm^3 and the system was allowed to attain equilibrium at that temperature.

(a) (i) Calculate the reaction quotient Q_c for the system under the initial conditions.

$[PCl_{5(g)}] = \frac{0.84\ mol}{4.0\ dm^3} = 0.21\ M$

$[PCl_{3(g)}] = \frac{0.16\ mol}{4.0\ dm^3} = 0.04\ M$

$[Cl_{2(g)}] = \frac{0.16\ mol}{4.0\ dm^3} = 0.04\ M$

$\therefore Q_c = \frac{0.04 \times 0.04}{0.21} = 7.62 \times 10^{-3}\ mol\ dm^{-3}$

(ii) Explain whether the concentration of $PCl_5(g)$ would increase or decrease just after the reaction started.

As the value of Q_c is larger than the value of K_c, the rate of forward reaction is smaller than that of backward reaction. So the equilibrium position would shift to the right after the reaction started. to increase the forward reaction rate. So the concentration of $PCl_{5(g)}$ increases. (4 marks)

(b) Explain whether K_c would increase, decrease or remain unchanged if the temperature of the equilibrium mixture is increased.

If the temperature of the equilibrium mixture is increased. the K_c would decrease. because less energy is needed to reach the equilibrium. (2 marks)

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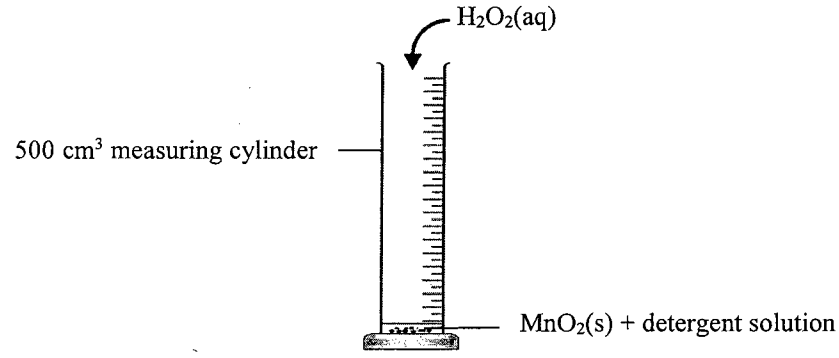
10. At room conditions, $H_2O_2(aq)$ would decompose into $O_2(g)$ and $H_2O(l)$ very slowly in the absence of $MnO_2(s)$. An experiment was performed as shown in the set-up below :



When 10.0 cm^3 of 3.00 M $H_2O_2(aq)$ was mixed with a small amount of $MnO_2(s)$ and detergent solution at room conditions, $O_2(g)$ started to be released rapidly and foam was produced. The $MnO_2(s)$ remained chemically unchanged at the end of the reaction.

(a) Write a chemical equation for the decomposition of $H_2O_2(aq)$.

$2H_2O_2(aq) \xrightarrow[\text{room conditions}]{MnO_2(s) \text{ and detergent solution}} 2H_2O(l) + O_2(g)$

(1 mark)

(b) Explain how manganese illustrates a characteristic of transition metals according to the results of this experiment.

~~Because~~ $MnO_2(s)$ is the catalyst of the reaction as it remains chemically unchanged at the end of the reaction and the speed of the reaction increases. This shows the catalytic properties of transition metals. (1 mark)

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Answers written in the margins will not be marked.

10. (c) Upon completion of the reaction, all the $H_2O_2(aq)$ was used up. Calculate the theoretical volume of $O_2(g)$ released at room conditions.
(Molar volume of gas at room conditions = 24 dm^3)

$n_{H_2O_2(aq)} = 3.00M \times \left(\frac{10.0}{1000}\right) dm^3 = 0.03\ mol$

$n_{H_2O_2} : n_{O_2} = 2 : 1$

$\therefore n_{O_2} = \frac{1}{2} \times 0.03\ mol = 0.15\ mol$

$V = 0.15\ mol \times 24\ dm^3 = 3.6\ dm^3$.

(2 marks)

(d) In the experiment, the time taken for the foam to rise from the mark at 100 cm^3 to the mark at 200 cm^3 of the measuring cylinder was 18 seconds, while the time taken for the foam to rise from the mark at 200 cm^3 to the mark at 300 cm^3 was 63 seconds. Explain these results.

(2 marks)

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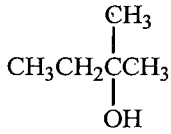
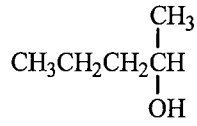
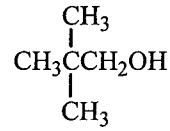
11. Compounds **P**, **Q** and **R** are structural isomers having the molecular formula of $C_5H_{12}O$. Their structures are shown below :



P



Q



R

(a) Give the systematic name of **P**.

(1 mark)

(b) Heating **Q** with acidified $K_2Cr_2O_7(aq)$ under reflux will give an organic product.

(i) Draw a labelled diagram to show the set-up for this reaction.

(ii) State the expected observation for this reaction.

The orange colour changes to green.

(iii) Write the structural formula of the organic product.

(4 marks)

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11. (c) **W** is an organic compound containing five carbon atoms. Under suitable conditions, **R** can be prepared from the reduction of **W**.

(i) Suggest the structural formula of **W**.

(ii) Suggest a reducing agent required for the reaction.

$LiBH_4$ in dry ether and acidic medium.

(2 marks)

(d) Compound **S** is an optically active secondary alcohol. It is also a structural isomer of compounds **P**, **Q** and **R**. Write the structural formula of **S**.

(1 mark)

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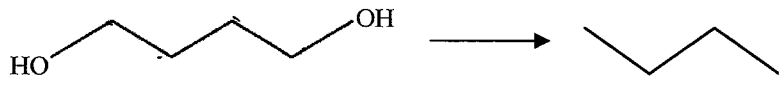
12. Outline a synthetic route, with NO MORE THAN THREE STEPS, to accomplish the following conversion. For each step, give the reagent(s), reaction conditions (as appropriate) and structure of the organic product.



(3 marks)

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*13. Describe the acid-base properties of the products formed (if any) when the following oxides are added to water separately. Chemical equations are NOT required.

Na_2O MgO Al_2O_3 Cl_2O

(5 marks)

Na_2O and Cl_2O would show acid properties when they are added to water. They are acidic oxides. And MgO would show base properties when it is added to water as it is basic oxides. Al_2O_3 would show both acidic and base properties when it is added to the water because it is amphoric oxide.

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PERIODIC TABLE 周期表

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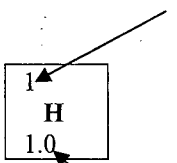

I	II											III	IV	V	VI	VII	0
																	2 **He** 4.0
3 **Li** 6.9	4 **Be** 9.0											5 **B** 10.8	6 **C** 12.0	7 **N** 14.0	8 **O** 16.0	9 **F** 19.0	10 **Ne** 20.2
11 **Na** 23.0	12 **Mg** 24.3											13 **Al** 27.0	14 **Si** 28.1	15 **P** 31.0	16 **S** 32.1	17 **Cl** 35.5	18 **Ar** 40.0
19 **K** 39.1	20 **Ca** 40.1	21 **Sc** 45.0	22 **Ti** 47.9	23 **V** 50.9	24 **Cr** 52.0	25 **Mn** 54.9	26 **Fe** 55.8	27 **Co** 58.9	28 **Ni** 58.7	29 **Cu** 63.5	30 **Zn** 65.4	31 **Ga** 69.7	32 **Ge** 72.6	33 **As** 74.9	34 **Se** 79.0	35 **Br** 79.9	36 **Kr** 83.8
37 **Rb** 85.5	38 **Sr** 87.6	39 **Y** 88.9	40 **Zr** 91.2	41 **Nb** 92.9	42 **Mo** 95.9	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 * **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 ** **Ac** (227)	104 **Rf** (261)	105 **Db** (262)													

*	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
**	90 **Th** 232.0	91 **Pa** (231)	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

Level 3 Exemplar 1
Paper 2

2022 DSE (D)

香 港 考 試 及 評 核 局
HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

香 港 中 學 文 憑 考 試
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

答 題 簿
ANSWER BOOK

由考生填寫 To be filled in by the candidate	
試題編號 Question No.	1
	3

考生須知

(一) 宣布開考後，考生須首先在第 1 頁之適當位置填寫考生編號，並在第 1 及 3 頁之適當位置貼上電腦條碼。

(二) 每題(非指分題)必須另起新頁作答，並須在每一頁的相應試題編號方格填畫「X」號，以表示選答的題號(見下例)，並在第一頁之適當位置填寫作答的試題編號。

(三) 紙張兩面均應使用，並應每行書寫。不可在各頁邊界以外位置書寫。寫於邊界以外的答案，將不予評閱。

(四) 如有需要，可要求派發方格紙及補充答題紙。每一紙張均須填寫考生編號、填畫試題編號方格、貼上電腦條碼，並用繩縛於**簿內**。

(五) 試場主任宣布停筆後，考生不會獲得額外時間貼上電腦條碼及填畫試題編號方格。

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1 and 3.

(2) Start each question (not part of a question) on a new page. Put 'X' in the corresponding question number box on each page to indicate the appropriate question number (see the example below), and write the question number(s) of the question(s) attempted in the space provided on Page 1.

(3) Write on both sides using each line. Do not write in the margins. Answers written in the margins will not be marked.

(4) Graph paper and supplementary answer sheets will be supplied on request. Write your Candidate Number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this book.

(5) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

例 Example:

試題編號 Question No. = 3

試題編號 Question No.

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試題編號 Question No.

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X											

13	14	15	16	17	18	19	20	21	22	23	24	≥25

每題另起新頁作答。
Start each question on a new page.

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

1(a)(i)(1) No poisonous or harzardous product is ~~is~~ formed

(2) Use of catalyst

(ii)(1) It is to increase the surface area of mixture to contact with catalyst and speed up the reaction

(2) Because the catalyst may be ~~is~~ polluted and become less effective.

(iii) Soapless detergent

(b)(i) -Water

(ii)(1) Chlorine gas

(2) Cl^- ions are preferentially discharged to form $Cl_2(g)$ because its concentration is higher than other ions.

(iii)(1) ~~$H_2(g)$~~ $2H^+(aq) + 2OH^-(aq) \rightarrow 2H_2O(l) + 2e^-$

(2)

(iv) Sodium chloride.

(c)(i) Initial rate refers the rate of the reaction at the beginning without any changes

(ii) ~~H^+ ions are used to provide an acidic medium for the reaction. And the rate of reaction is not affected by~~

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

試題編號 Question No.

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每題另起新頁作答。
Start each question on a new page.

(iii) concentration of $H^+(aq)$ does not affect the rate of reaction even if it is much higher than that of $S_2O_3^{2-}(aq)$. So the rate of reaction is depends on the concentration of $S_2O_3^{2-}(aq)$ only

(iii) $\log r_0 = \log[S_2O_3^{2-}(aq)]_0 + \log k$

~~When $\log r_0 =$~~ $\therefore \log k = \text{slope} = \frac{0.4}{0.4} = 1$

$\log r_0 = -1.10$, $\log[S_2O_3^{2-}(aq)] = -1.84$

$\log r_0 = -1.50$, $\log[S_2O_3^{2-}(aq)] = -2.24$

~~$\log$~~ $\log[S_2O_3^{2-}(aq)]_0^x + 1 = -1.10$

$x \log[S_2O_3^{2-}(aq)]_0 = -2.1$

$\therefore x = 1.14$

$1 + x\log[S_2O_3^{2-}(aq)] = -2.24 - 1.50$

$\therefore x = 1.116$

$\therefore$ The order of reaction with respect to $S_2O_3^{2-}(aq)$ is 1

(iv) $\log k = K_1 - \frac{Ea}{2.3 \times 8.31 \times 25°C}$ = let K_1 be x. $\therefore K_2 - K_1 = 1.9 - 1.0$

$\therefore K_2 = 1.9x$

$\log k = x - \frac{Ea}{2.3 \times 8.31 \times 25} = x - \frac{Ea}{477.8J}$

$\log k = 1.9x - \frac{Ea}{2.3 \times 8.31 \times 35} = 1.9x - \frac{Ea}{668.9J}$

$1.9x - \frac{Ea}{668.9J} = x - \frac{Ea}{477.8J}$

$0.9x = \frac{Ea}{668.9J} - \frac{Ea}{477.8J}$

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Answers written in the margins will not be marked.

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試題編號 Question No.

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每題另起新頁作答。
Start each question on a new page.

3(a)(iii) *

(iii) Because CH_3CH_2CHO (l) contains aldehyde group while CH_3COCH_3 (l) contains a ketone group. The presence of absorption peak in their mass spectra would be in the different range.

(iii) Concentrated sulphuric acid

(b)(i) $3.04g \times \frac{50}{100} cm^3 = 1.52g > 1.40g$

∴ All of Y ~~are~~ should have dissolved in step (1)

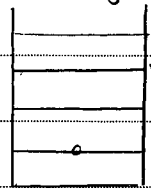
(ii) ~~It is to filter out the water-insoluble~~ remove

It is to remove the water-insoluble activated charcoal with impurity Z from the mixture

(iii) ~~Crystallization by evaporation to~~ crystallization

(iv) Not all of Y ~~is~~ become solid. Some of Y is contained in the solution filtered away.

(v)(1)



(2) The first collected fraction is Z. Because the Rf value of Y is greater than Z. It would have greater distance from the Rf0.

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每題另起新頁作答。
Start each question on a new page.

c) (i) (1) Because the $Fe^{3+}_{(aq)}$ ions are formed and ~~present~~ shows a pale yellow colour at first. ~~And it redissolve again~~ And then ~~Mn^{2+} (aq) ions are formed~~ MnO_4^- (aq) ions are reduced to Mn^{2+} (aq) ions which is pale pink in colour.

(2) no. of moles of $KMnO_4$ (aq) = $0.00411\ M \times (\frac{32.35}{1000})\ dm^3$

$= 1.32635 \times 10^{-4}$ mol

$n MnO_4^- : n Fe^{2+} = 1 : 5$

$\therefore n Fe^{2+} = 5\ n MnO_4 =$ ~~2.6527×10^{-5} mol~~ 6.63175×10^{-4} mol

concentration = $\frac{6.63175 \times 10^{-4}\ mol}{(\frac{25.00}{1000})\ dm^3}$ = ~~0.0265~~ 0.027 M

(ii) (1)

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每題另起新頁作答。
Start each question on a new page.

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每題另起新頁作答。
Start each question on a new page.

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每題另起新頁作答。
Start each question on a new page.

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Answers written in the margins will not be marked.

B

Level 3 Exemplar 2
Paper 1B

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2022

CHEMISTRY PAPER 1

SECTION B : Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5, 7 and 9.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) This section consists of **TWO** parts, Parts I and II.

(4) Answer **ALL** questions in both Parts I and II. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(5) An asterisk (*) has been put next to the questions where one mark will be awarded for effective communication.

(6) Supplementary answer sheets will be provided on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this Question-Answer Book.

(7) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

* A 1 4 0 E 0 1 B *

PART I

Answer **ALL** questions. Write your answers in the spaces provided.

1. Iodine is a halogen. It can form potassium iodide and hydrogen iodide.

(a) Name the relationship between $^{127}_{53}I$ and $^{129}_{53}I$.

Isotopes.

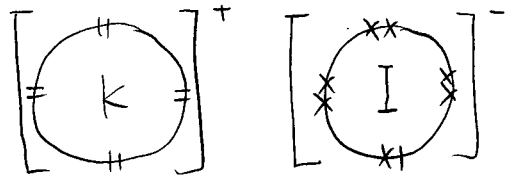
(1 mark)

(b) The electronic arrangement of an iodine atom is 2, 8, x, 18, y. What is x ?

X is 18.

(1 mark)

(c) Draw the electron diagram for potassium iodide, showing ELECTRONS IN THE OUTERMOST SHELLS only.



(1 mark)

(d) Suggest why an aqueous solution of hydrogen iodide can conduct electricity.

It contains mobile ions to conduct electricity.

(1 mark)

KI HI

(e) In terms of bonding and structure, explain whether potassium iodide or hydrogen iodide would have a higher melting point.

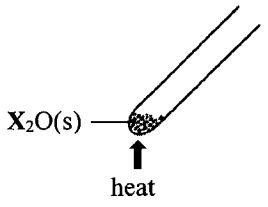
Potassium iodide have a higher melting point as it has larger molecular size.

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

2. The diagram below shows an experimental set-up in which a metal oxide $X_2O(s)$ is decomposed upon strong heating. A silvery metal **X** and a colourless gas **Z** are formed.



(a) State what **Z** is and suggest a test for it.

Z is oxygen and it can relight a glowing splint.

(2 marks)

(b) When 3.028 g of $X_2O(s)$ is completely decomposed, 2.819 g of metal **X** can be obtained.

(i) Calculate the relative atomic mass of **X**.
(Relative atomic mass : O = 16.0)

Let y be the relative atomic mass of X.

$$\frac{3.028}{2y+16} \times 2 = \frac{2.819}{y}$$

$$0.418y = 45.104$$

$$y = 107.9$$

∴ The relative atomic mass of X is 107.9.

(ii) Suggest what **X** is.

Silver.

(3 marks)

(c) Explain whether the decomposition of $X_2O(s)$ is a redox reaction.

The oxidation number of silver decrease from +1 to 0.
The oxidation number of oxygen increase from −2 to 0.
∴ Yes, it is a redox reaction.

(1 mark)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Go on to the next page

3. Antacid is a drug for neutralising stomach acid. A sample of an antacid contains $NaHCO_3(s)$ and other soluble inert substances. 1.52 g of the antacid sample was completely dissolved in deionised water to give a weakly alkaline solution. The solution was then titrated with 0.644 M HCl(aq) using a suitable indicator. 25.20 cm^3 of the HCl(aq) was required to reach the end point.

(a) Write the chemical equation for the reaction between $NaHCO_3(s)$ and HCl(aq).

$NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + CO_2(g) + H_2O(l)$

(1 mark)

(b) Calculate the percentage by mass of $NaHCO_3(s)$ in the antacid sample.
(Relative atomic masses : H = 1.0, C = 12.0, O = 16.0, Na = 23.0)

No. of moles of $HCl = (0.644\,M)\left(\frac{25.20}{1000}\right)$

$= 0.0162$ mol

mass of $NaHCO_3 = 0.0162 \times (23.0 + 1.0 + 12.0 + 3 \times 16)$

$= 1.36$ g

percentage by mass $= \frac{1.36}{1.52} \times 100\%$

$= 89.6\%$

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

3. (c) The pH of the solution at the end point of the titration was found to be between 3 and 4.

(i) Suggest a suitable indicator for this titration and state the colour change at the end point.

Use methyl orange.
The colour should be change from yellow to red.

(ii) Suggest an instrument to measure the pH of the solution accurately.

colorimeter

(3 marks)

(d) State one advantage of taking antacids containing $Mg(OH)_2(s)$ over those containing $NaHCO_3(s)$.

$NaHCO_3$ may cause side effect while $Mg(OH)_2$ do not.

(1 mark)

Answers written in the margins will not be marked.

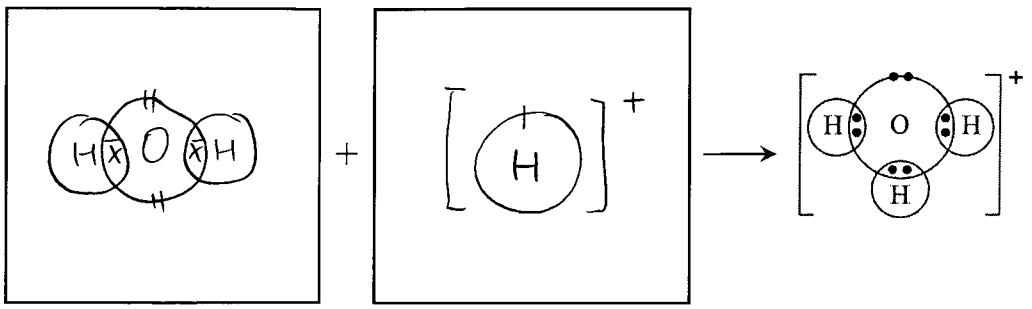
Answers written in the margins will not be marked.

Go on to the next page

4. Consider the molecules H_2O, BF_3 and SF_6.

(a) H_2O molecules can form H_3O^+ ions.

(i) In each of the following boxes, draw the electron diagram (showing ELECTRONS IN THE OUTERMOST SHELLS only) for a suitable chemical species to show the formation of a H_3O^+ ion.



(ii) Describe the formation of dative covalent bond using H_3O^+ as an example.

In H^+ ions, it has only 1 outermost shell electrons and it need 1 more electron to acquire the octet rule.
In H_2O molecules, O atom share 1 electron to H atom to form a dative covalent bond.

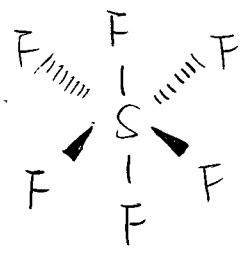
(3 marks)

(b) Explain whether the boron atom in a BF_3 molecule has an octet structure.

The boron atom do not has an octet structure as the outermost shell electron of boron only has 6 electrons.

(1 mark)

(c) (i) Draw the three-dimensional structure of a SF_6 molecule.



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4. (c) (ii) Explain whether SF_6 is a polar molecule.

SF_6 is not a polar molecule.
As SF_6 has an octehedral shape,
and it is highly symmetrically.
The 6 S-F ^ cancel out each other.
would

(2 marks)

(d) Explain the following increasing order of the boiling points of the three compounds :

$BF_3 < SF_6 < H_2O$

The intermolecular structure of H_2O is hydrogen bond while BF_3 and SF_6 are simple molecular structure
∴ H_2O has the highest melting point.

The molecular size of SF_6 is larger than that of BF_3.
∴ The melting point of SF_6 is higher than BF_3.

The hydrogen bond is stronger than Van der Waals' force.

(3 marks)

Answers written in the margins will not be marked.

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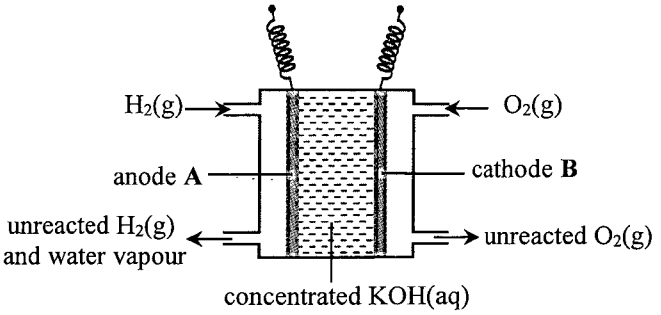
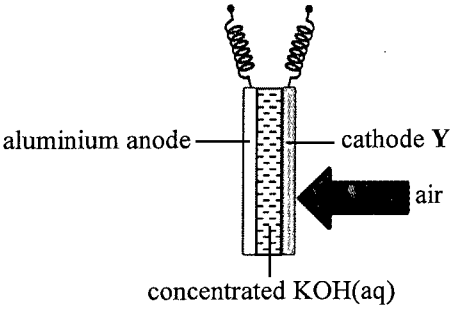
5. The following hydrogen-oxygen fuel cell and aluminium-air cell are primary cells. Their simplified structures are shown below :



hydrogen-oxygen fuel cell



aluminium-air cell

(a) What is meant by the term 'primary cell' ?

primary cell is unrenewable.

(1 mark)

(b) For the above hydrogen-oxygen fuel cell,

(i) write the half equation for the change that occurs at anode **A**.

$4OH^-_{(aq)} \longrightarrow O_{2(g)} + 2H_2O_{(l)} + 4e^-$

(ii) suggest one disadvantage of using this hydrogen-oxygen fuel cell.

It is expensive.

(2 marks)

(c) In the above aluminium-air cell, oxygen in air reacts with water to form hydroxide ions at cathode **Y**.

(i) Write the half equation for the change that occurs at cathode **Y**.

$O_{2(g)} + 2H_2O_{(l)} + 4e^- \longrightarrow 4OH^-_{(aq)}$

(ii) The half equation for the change that occurs at the aluminium anode is as follows :

$$Al(s) + 3OH^-(aq) \rightarrow Al(OH)_3(s) + 3e^-$$

Write the chemical equation for the overall reaction in the aluminium-air cell.

$4Al(s) + 3O_2(g) + 6H_2O(l) \rightarrow 4Al(OH)_3(s)$

(iii) Suggest how aluminium can be obtained from aluminium oxide.

Electrolysis of molten ore.

(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

6. Consider the following chemical equation for the formation of CH_3Cl from methane and chlorine :

$$CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$$

(a) Name the type of reaction involved.

Substitution reaction.

(1 mark)

(b) State the condition needed for the reaction to occur at room temperature.

Carry out the reaction under sun light.

(1 mark)

(c) The reaction involves three stages: initiation, propagation and termination. In the initiation stage, chlorine free radicals (Cl•) are formed from chlorine molecules.

(i) With reference to the electronic structure, explain why a chlorine free radical (Cl•) is a reactive chemical species.

The outermost shell electrons of Cl is 7 and it loses electron very readily.

(ii) Complete the chemical equations below by filling in a suitable chemical species in each of the following boxes :

One of the steps in the propagation stage :

$$Cl\bullet + CH_4 \rightarrow \boxed{CH_3Cl} + \boxed{H^+}$$

One of the steps in the termination stage :

$$\boxed{Cl\bullet} + \boxed{CH_3} \rightarrow CH_3Cl$$

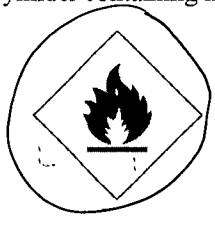
(3 marks)

(d) Explain why CH_3Cl is not the only organic product formed in the reaction between methane and chlorine.

As CH_3Cl is a mixture.

(1 mark)

(e) From the hazard warning labels shown below, circle a label that should be displayed on a gas cylinder containing methane.




(1 mark)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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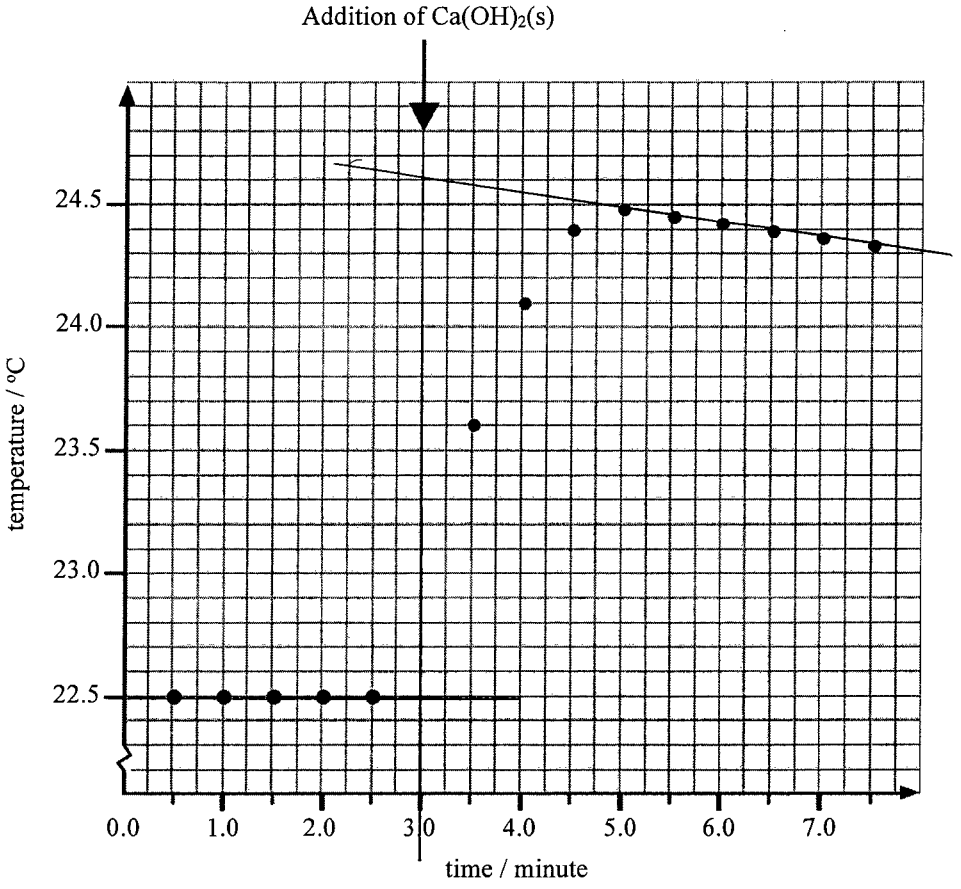
7. An experiment was performed to determine the enthalpy change of neutralisation between $Ca(OH)_2(s)$ and HCl(aq). 100.0 cm^3 of 1.0 M HCl(aq) was placed in an expanded polystyrene cup. The temperature of the contents in the cup was measured at half-minute intervals. Right at the third minute, 0.502 g of $Ca(OH)_2(s)$ was added to the cup with thorough stirring. The recordings of temperature are shown in the graph below :



(a) Write a chemical equation for the reaction between $Ca(OH)_2(s)$ and HCl(aq).

$Ca(OH)_2(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + 2H_2O(l)$

(1 mark)

(b) (i) By SKETCHING on the graph above, estimate the greatest temperature rise of the contents in the cup.

The greatest temperature rise = 2.1 °C

7. (b) (ii) It is given that the enthalpy change of neutralisation is the enthalpy change when solutions of an acid and an alkali react together to produce one mole of water.

In the experiment, HCl(aq) is in excess. Calculate the enthalpy change of neutralisation between $Ca(OH)_2(s)$ and HCl(aq), in kJ mol^{-1}, under the experimental conditions.

(Volume of the reaction mixture = 100.0 cm^3;
density of the reaction mixture = 1.00 g cm^{-3};
specific heat capacity of the reaction mixture = 4.2 J g^{-1} K^{-1};
heat capacity of the expanded polystyrene cup : negligible)
(Relative atomic masses : H = 1.0, O = 16.0, Cl = 35.5, Ca = 40.1)

enthalpy change $= \dfrac{(0.50\,2)(4.2)(2.1)}{40.1 + 2 \times (16+1)}$

$= \dfrac{4.42764}{74.1}$

$= 0.060$ kJ mol^{-1}

(5 marks)

(c) Standard enthalpy changes of neutralisation $\Delta H_n^\ominus$ for two reactions are given below :

	$\Delta H_n^\ominus$ / kJ mol^{-1}
Reaction between $Ca(OH)_2(s)$ and HCl(aq)	−58.6
Reaction between CaO(s) and HCl(aq)	−186.0

Calculate the standard enthalpy change of the following reaction.

$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(s)$

$CaO \rightarrow Ca + \frac{1}{2}O_2$ $\quad +186.0$ kJ mol^{-1}

$H_2O \rightarrow$

(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Go on to the next page

*8. Describe and explain the similarities and differences between the chemical principles involved in tin-plating and galvanising in the rusting prevention of iron-made objects.

(6 marks)

Similarity = Both can prevent the iron from contacting with oxygen in air to cause rusting.

Difference = Tin-plating is toxic while galvanising is not.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

PART II

Answer **ALL** questions. Write your answers in the spaces provided.

9. At a certain temperature, the equilibrium constant K_c for the following reaction is 2.25×10^{-2} mol dm^{-3}.

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g) \qquad \Delta H > 0$$

In an experiment, 0.84 mol of $PCl_5(g)$, 0.16 mol of $PCl_3(g)$ and 0.16 mol of $Cl_2(g)$ were initially introduced in a closed container of a fixed volume of 4.0 dm^3, and the system was allowed to attain equilibrium at that temperature.

(a) (i) Calculate the reaction quotient Q_c for the system under the initial conditions.

$$Q_c = \frac{[Cl_2(g)][PCl_3(g)]}{[PCl_5(g)]}$$

$$= \frac{\left(\frac{0.16}{4}\right)\left(\frac{0.16}{4}\right)}{\left(\frac{0.84}{4}\right)}$$

$$= 7.62 \times 10^{-3} \text{ mol dm}^{-3}$$

(ii) Explain whether the concentration of $PCl_5(g)$ would increase or decrease just after the reaction started.

Increase.
As the number of moles of gaseous products is higher than that of gaseous reactant. The pressure of right is higher than left.
∴ The equilibrium position will shift to left. (4 marks)

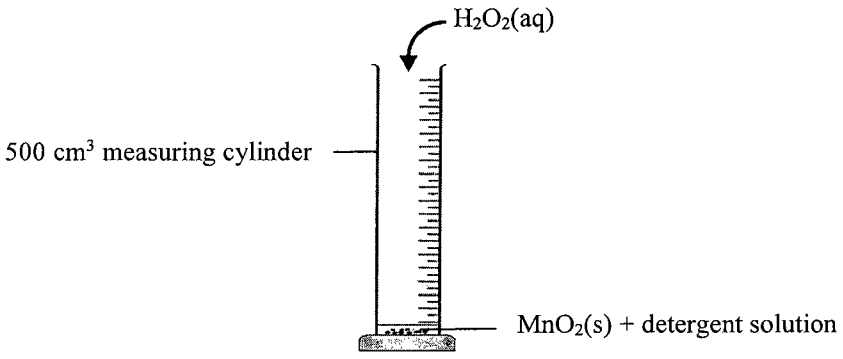
(b) Explain whether K_c would increase, decrease or remain unchanged if the temperature of the equilibrium mixture is increased.

The forward reaction is exothermic.
When the temperature increased, the equilibrium position will shift to left to decrease the temperature. (2 marks)
∴ K_c would be decreased.

Answers written in the margins will not be marked.

Go on to the next page

10. At room conditions, $H_2O_2(aq)$ would decompose into $O_2(g)$ and $H_2O(l)$ very slowly in the absence of $MnO_2(s)$. An experiment was performed as shown in the set-up below :



When 10.0 cm^3 of 3.00 M $H_2O_2(aq)$ was mixed with a small amount of $MnO_2(s)$ and detergent solution at room conditions, $O_2(g)$ started to be released rapidly and foam was produced. The $MnO_2(s)$ remained chemically unchanged at the end of the reaction.

(a) Write a chemical equation for the decomposition of $H_2O_2(aq)$.

(1 mark)

(b) Explain how manganese illustrates a characteristic of transition metals according to the results of this experiment.

(1 mark)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

10. (c) Upon completion of the reaction, all the $H_2O_2(aq)$ was used up. Calculate the theoretical volume of $O_2(g)$ released at room conditions.
(Molar volume of gas at room conditions = 24 dm^3)

(2 marks)

(d) In the experiment, the time taken for the foam to rise from the mark at 100 cm^3 to the mark at 200 cm^3 of the measuring cylinder was 18 seconds, while the time taken for the foam to rise from the mark at 200 cm^3 to the mark at 300 cm^3 was 63 seconds. Explain these results.

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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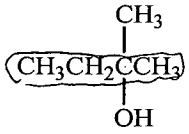
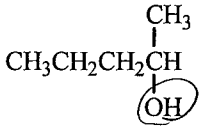
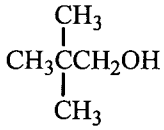
11. Compounds **P**, **Q** and **R** are structural isomers having the molecular formula of $C_5H_{12}O$. Their structures are shown below :



P



Q



R

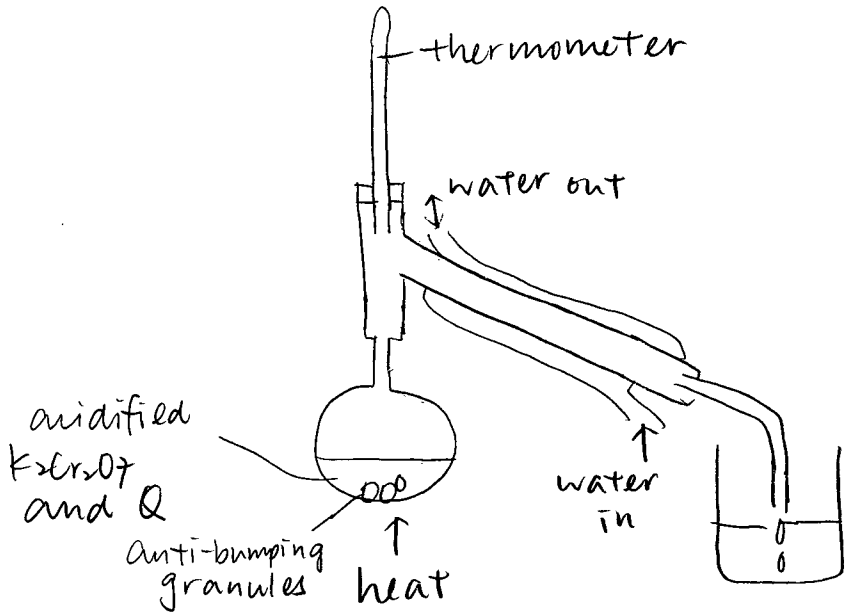
(a) Give the systematic name of **P**.

2-methylbutan-2-ol

(1 mark)

(b) Heating **Q** with acidified $K_2Cr_2O_7$(aq) under reflux will give an organic product.

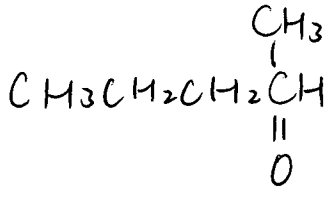
(i) Draw a labelled diagram to show the set-up for this reaction.



(ii) State the expected observation for this reaction.

The colour of change from orange to colourless.

(iii) Write the structural formula of the organic product.



(4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

11. (c) **W** is an organic compound containing five carbon atoms. Under suitable conditions, **R** can be prepared from the reduction of **W**.

(i) Suggest the structural formula of **W**.

(ii) Suggest a reducing agent required for the reaction.

(2 marks)

(d) Compound **S** is an optically active secondary alcohol. It is also a structural isomer of compounds **P**, **Q** and **R**. Write the structural formula of **S**.

(1 mark)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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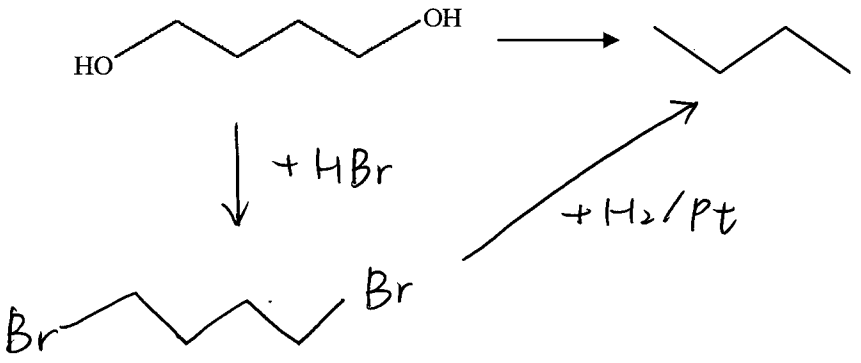
12. Outline a synthetic route, with NO MORE THAN THREE STEPS, to accomplish the following conversion. For each step, give the reagent(s), reaction conditions (as appropriate) and structure of the organic product.



(3 marks)

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Answers written in the margins will not be marked.

*13. Describe the acid-base properties of the products formed (if any) when the following oxides are added to water separately. Chemical equations are NOT required.

Na_2O MgO Al_2O_3 Cl_2O

(5 marks)

Na_2O is alkaline when it is added with water, and it form NaOH, which is an alkali.

MgO form MgOH when it is added to water. MgOH is an alkali.

~~Al~~ Al_2O_3 is amphoteric, whic is acidic and alkaline.

END OF SECTION B
END OF PAPER

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

PERIODIC TABLE 周期表

GROUP 族

atomic number 原子序

relative atomic mass 相對原子質量

I	II											III	IV	V	VI	VII	0
																	2 **He** 4.0
3 **Li** 6.9	4 **Be** 9.0											5 **B** 10.8	6 **C** 12.0	7 **N** 14.0	8 **O** 16.0	9 **F** 19.0	10 **Ne** 20.2
11 **Na** 23.0	12 **Mg** 24.3											13 **Al** 27.0	14 **Si** 28.1	15 **P** 31.0	16 **S** 32.1	17 **Cl** 35.5	18 **Ar** 40.0
19 **K** 39.1	20 **Ca** 40.1	21 **Sc** 45.0	22 **Ti** 47.9	23 **V** 50.9	24 **Cr** 52.0	25 **Mn** 54.9	26 **Fe** 55.8	27 **Co** 58.9	28 **Ni** 58.7	29 **Cu** 63.5	30 **Zn** 65.4	31 **Ga** 69.7	32 **Ge** 72.6	33 **As** 74.9	34 **Se** 79.0	35 **Br** 79.9	36 **Kr** 83.8
37 **Rb** 85.5	38 **Sr** 87.6	39 **Y** 88.9	40 **Zr** 91.2	41 **Nb** 92.9	42 **Mo** 95.9	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 * **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 ** **Ac** (227)	104 **Rf** (261)	105 **Db** (262)													

*	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
**	90 **Th** 232.0	91 **Pa** (231)	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

Level 3 Exemplar 2
Paper 2

2022 DSE (D)

香 港 考 試 及 評 核 局
HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

香 港 中 學 文 憑 考 試
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

答 題 簿
ANSWER BOOK

由考生填寫 To be filled in by the candidate	
試題編號 Question No.	1
	3

考生須知

(一) 宣布開考後，考生須首先在第 1 頁之適當位置填寫考生編號，並在第 1 及 3 頁之適當位置貼上電腦條碼。

(二) 每題(非指分題)必須另起新頁作答，並須在每一頁的相應試題編號方格填畫「X」號，以表示選答的題號(見下例)，並在第一頁之適當位置填寫作答的試題編號。

(三) 紙張兩面均應使用，並應每行書寫。不可在各頁邊界以外位置書寫。寫於邊界以外的答案，將不予評閱。

(四) 如有需要，可要求派發方格紙及補充答題紙。每一紙張均須填寫考生編號、填畫試題編號方格、貼上電腦條碼，並用繩縛於**簿內**。

(五) 試場主任宣布停筆後，考生不會獲得額外時間貼上電腦條碼及填畫試題編號方格。

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1 and 3.

(2) Start each question (not part of a question) on a new page. Put 'X' in the corresponding question number box on each page to indicate the appropriate question number (see the example below), and write the question number(s) of the question(s) attempted in the space provided on Page 1.

(3) Write on both sides using each line. Do not write in the margins. Answers written in the margins will not be marked.

(4) Graph paper and supplementary answer sheets will be supplied on request. Write your Candidate Number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this book.

(5) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

例 Example:
試題編號 Question No. = 3

試題編號 Question No.

1	2	3	4	5	6	7	8	9	10	11	12	
☐	☐	X	☐	☐	☐	☐	☐	☐	☐	☐	☐	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13	14	15	16	17	18	19	20	21	22	23	24	≥25

試題編號 Question No.

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X											

13	14	15	16	17	18	19	20	21	22	23	24	≥25

每題另起新頁作答。
Start each question on a new page.

1 a) i) 1) Catalyst is used.

2) CO is toxic.

ii) 1) Using a porous structure can increase the surface area and increase the rate of the reaction.

2) The catalyst is used up.

iii) nylon rope

b) i) mercury

1) Chlorine gas

2) Cl^- is oxidized to form Cl_2.

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

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Answers written in the margins will not be marked.

試題編號 Question No.

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X											

13	14	15	16	17	18	19	20	21	22	23	24	≥25

每題另起新頁作答。
Start each question on a new page.

iii) 1) $2H^+(aq) \rightarrow H_2(g) + 2e^-$

2)

iv) NaCl

c) i) $r = 0$

ii)

iii) $-1.10 = k[-1.84$

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

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每題另起新頁作答。
Start each question on a new page.

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13	14	15	16	17	18	19	20	21	22	23	24	≥25

每題另起新頁作答。
Start each question on a new page.

3 a) i) Pass $SO_2(g)$ and $CO_2(g)$ into $K_2Cr_2O_7$.
SO_2 would decolourize the orange $K_2Cr_2O_7$ while CO_2 would not.

ii) In CH_3CH_2CHO, m/z of CH_3CO^+ is 43

In CH_3COCH_3, m/z of CH_3^+ is 15.

iii) anhydrous sodium sulphate

b) i) Mole ratio of 1.40g sample to 3.04g sample
= 1 : 2

ii) To filter the liquid to obtain Y.

iii) Crystalization

iv) The impurities are filtered.

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

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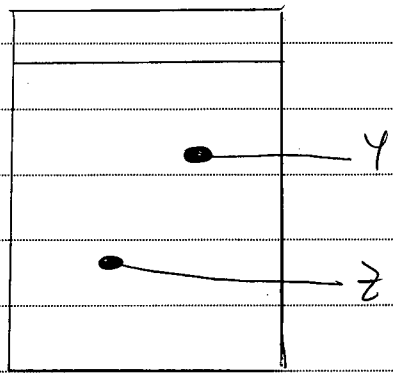
13	14	15	16	17	18	19	20	21	22	23	24	≥25

每題另起新頁作答。
Start each question on a new page.

v)



2) Y.

c) i) When the solution S is adding by $KMnO_4$, Fe^{2+} ions are oxidized to Fe^{3+} which is pale yellow. After the titration is done, if one more droplet of $KMnO_4$ is added, the purple $KMnO_4$ is added to a large amount of pale yellow mixture and change the colour to pale pink as there is no more Fe^{2+} would react with MnO_4^-.

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Answers written in the margins will not be marked.

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Answers written in the margins will not be marked.

試題編號 Question No.

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13	14	15	16	17	18	19	20	21	22	23	24	≥25	

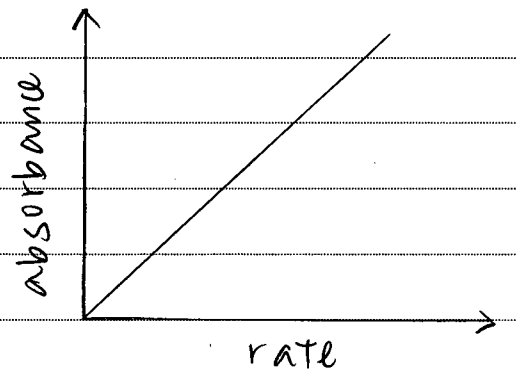
每題另起新頁作答。
Start each question on a new page.

2) No. of moles of MnO_4^- = $(0.0041)\left(\frac{32.35}{1000}\right)$
= 1.33×10^{-4}

No. of moles of Fe^{2+} = $1.33 \times 10^{-4} \times 5$
= 6.63×10^{-4}

Concentration of Fe^{2+} = $\frac{6.63 \times 10^{-4}}{\frac{25}{1000}}$
= $0.027\ mol/dm^3$

ii) 1)



2) The higher concentration of Fe^{2+} is, the faster the rate is.

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

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試題編號 Question No.

1	2	3	4	5	6	7	8	9	10	11	12	
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☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
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每題另起新頁作答。
Start each question on a new page.

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